

What is claimed is:

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5 1. A fastening device for promoting the assembly and adherence of associated pieces upon exposure to electromagnetic energy, comprising a susceptor sheet and a heat-activateable adhesive on at least one surface of said susceptor, wherein (a) when a test surface congruent in shape to the susceptor surface is placed on the outward side of the adhesive, at least about 35% of the area of adhesive in contact with said test surface can have inscribed within it circles having a diameter of about $\frac{1}{2}$ " or less.

2. The fastening device according to Claim 1 wherein at least about 35% of the area in contact with said test surface can have inscribed within it circles having a diameter of about $\frac{1}{4}$ " or less.

3. The fastening device according to Claim 2 wherein the susceptor has a thickness of no greater than about 2 mils.

4. The fastening device according to Claim 3 wherein (b) from about 0.001% to about 65% of the area of the test surface is in pre-bonding contact with the outward side of the adhesive.

5. The fastening device according to Claim 4 wherein the contact between the adhesive and the susceptor is discontinuous.

6. The fastening device according to Claim 5 wherein (c) when a test surface congruent in shape to the susceptor is placed against the inward side of the adhesive, at least about 35% of the area of the inward side of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of $\frac{1}{2}$ " or less.

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7. The fastening device according to Claim 6 wherein at least about 35% of the area of the inward side of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of about $\frac{1}{4}$ " or less.

8. ~~The fastening device according to Claim 7 wherein (d) from about 0.001% to about 65% of the area of the test surface is in contact with the inward side of the adhesive.~~

9. The fastening device according to Claim 6 wherein the area represented by (a) and (b) is less than the area represented by (c) and (d).

10. The fastening device according to Claim 6 wherein (e) from about 0.05% to about 65% of the total area of the test surface is in contact with the adhesive as measured by the post-bonding test procedure defined herein.

11. The fastening device according to Claim 10 additionally comprising a supplemental layer having a thickness of up to about 10 mils between the susceptor and the adhesive.

12. The fastening device according to Claim 11 wherein the supplemental layer is selected from the group consisting of insulation, foam, a continuous layer of adhesive, scrim, a paper material, a thermoplastic material, and mixtures thereof.

13. The fastening device according to Claim 12 wherein the supplemental layer is a continuous layer of adhesive.

14. The fastening device according to Claim 10 which additionally comprises a primer located on the surface of the susceptor sheet between the susceptor and the adhesive layer.

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15. The fastening device according to Claim 10 wherein

at least about 50% of the area of the outward surface of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of about 1/4" or less;

5 from about 0.001% of to about 15% of the area of the test surface is in pre-bonding contact with the outward surface of the adhesive; and

from about 1% to about 35% of the total area of the test surface is in contact with the adhesive, as measured by the post-bonding test procedure defined herein.

16. The fastening device according to Claim 10 wherein the susceptor is activateable by induction heating.

17. The fastening device according to Claim 16 wherein the susceptor is activateable by frequencies of about 1,000 kHz or less.

18. The fastening device according to Claim 17 wherein the susceptor is selected from metallic foils and non-metallic foils.

19. The fastening device according to Claim 10 wherein the susceptor's surface is textured.

20. The fastening device according to Claim 10 wherein the susceptor's surface is perforated.

21. The fastening device according to Claim 18 wherein the adhesive is selected from hot-melt adhesives, curable adhesives, and mixtures thereof.

22. The fastening device according to Claim 21 wherein the adhesive softens at a temperature of at least about 60°C.

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23. The fastening device according to Claim 22 wherein the adhesive layer includes both hot-melt adhesive and pressure-activated adhesive.

24. The fastening device according to Claim 10 wherein the adhesive is selected from hot-melt adhesives, curable adhesives, and mixtures thereof.

25. The fastening device according to Claim 24 wherein the hot-melt adhesive is selected from polyamides, polyolefins, ethylene/vinyl acetate copolymers, and mixtures thereof.

26. The fastening device according to Claim 25 wherein the susceptor is a metallic foil comprising materials selected from the group consisting of metallic fibrous materials, conductive metal materials, conductive magnetic materials, and mixtures thereof.

27. The fastening device according to Claim 26 wherein the metallic foil is made from a metal selected from the group consisting of steel, copper, iron, nickel, tin, aluminum, and mixtures thereof.

28. The fastening device according to Claim 27 wherein the susceptor sheet has a thickness of no greater than about 1 mil.

29. The fastening device according to Claim 28 wherein the susceptor sheet is made from aluminum foil.

30. The fastening device according to Claim 22 wherein the adhesive is located on one surface of the susceptor sheet.

31. The fastening device according to Claim 22 wherein the adhesive is located on both surfaces of the susceptor sheet.

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32. The fastening device according to Claim 22 wherein the adhesive is present on the susceptor sheet in the form of a web configuration selected from random webs, ordered webs, and mixtures thereof.

33. The fastening device according to Claim 22 wherein the adhesive is concentrated close to the edges of the susceptor.

34. The fastening device according to Claim 22 wherein the adhesive is present on the susceptor sheet in a discontinuous pattern.

35. The fastening device according to Claim 34 wherein the adhesive is placed on the susceptor sheet in a pattern selected from spots, lines, cones, pyramids, cylinders, cubes, spheres, donuts, stars, and mixtures thereof.

36. The fastening device according to Claim 22 formulated in the form selected from moldings, wall coverings, wallboard, laminates, carpeting, fabric and floor coverings.

37. The fastening device according to Claim 17 wherein the susceptor is selected from the group consisting of foils, agglomerated threads, agglomerated particles and mixtures thereof.

38. The fastening device according to Claim 22 activated by electromagnetic energy having a frequency of about 500 kHz or less.

39. The fastening device according to Claim 22 wherein:

at least about 50% of the area of the outward surface of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of about 1/4" or less; and

5 from about 0.001% to about 15% of the area of the test surface is in pre-bonding contact with the outward surface of the adhesive; and

from about 1% to about 35% of the total area of the test surface is in contact with the adhesive as measured by the post-bonding test procedure defined herein.

40. The fastening device according to Claim 39 wherein at least about 50% of the area of the outward surface of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of about 3/16" or less.

41. The fastening device according to Claim 40 wherein at least about 75% of the area of the outward surface of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of about 3/16" or less.

42. The fastening device according to Claim 40 wherein from about 5% to about 25% of the total area of the test surface is in contact with the adhesive measured by the post-bonding test procedure defined herein.

43. The fastening device according to Claim 22 which is substantially flat.

44. The fastening device according to Claim 35 wherein the adhesive decreases in cross-sectional area as one moves away from the susceptor and toward the surface to be bonded.

45. The fastening device according to Claim 12 wherein the supplemental layer is a continuous layer of adhesive and the adhesive is placed on top of that supplemental layer.

46. The fastening device according to Claim 45 wherein the adhesive is placed on top of the supplemental layer in the form of a web configuration selected from random webs, ordered webs, and mixtures thereof.

47. The fastening device according to Claim 46 wherein the susceptor is an aluminum foil.

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48. The fastening device according to Claim 47 wherein the adhesive is a polyamide.

49. The fastening device according to Claim 47 wherein the adhesive is located on one face of the susceptor.

50. The fastening device according to Claim 47 wherein the adhesive is located on both faces of the susceptor.

51. The fastening device according to Claim 29 wherein the adhesive is placed on the susceptor in the form of a web configuration selected from random webs, ordered webs and mixtures thereof.

52. The fastening device according to Claim 51 wherein the adhesive is a polyamide.

53. The fastening device according to Claim 52 wherein the adhesive is located on one face of the susceptor.

54. The fastening device according to Claim 52 wherein the adhesive is located on both faces of the susceptor.

55. The fastening device according to Claim 54 in the form of a nestable tape.

56. The fastening device according to Claim 29 wherein the adhesive is present on the susceptor sheet in a discontinuous pattern selected from spots, lines, cones, pyramids, cylinders, cubes, spheres, stars and mixtures thereof.

57. The fastening device according to Claim 56 wherein the adhesive is a polyamide.

58. The fastening device according to Claim 57 wherein the adhesive is located on one side of the susceptor.

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59. The fastening device according to Claim 57 wherein the adhesive is located on both sides of the susceptor.

60. A fastening device for promoting the assembly and adherence of associated pieces upon exposure to electromagnetic energy, comprising a susceptor sheet and a heat-activatable adhesive on at least one surface of said susceptor, wherein (c) when a test surface congruent in shape to the susceptor is placed against the inward side of the adhesive at least about 35% of the area of the inward side of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of $\frac{1}{2}$ " or less.

61. The fastening device according to Claim 60 wherein at least about 35% of the area of the inward side of the adhesive in contact with said test surface can have inscribed within it circles having a diameter of $\frac{1}{4}$ " in or less.

62. The fastening device according to Claim 61 wherein the susceptor has a thickness of no greater than about 2 mils.

63. The fastening device according to Claim 62 wherein (d) from about 0.001% to about 65% of the area of the test surface is in contact with the inward side of the adhesive.

64. The fastening device according to Claim 63 wherein the contact between the adhesive and the surface to be bonded is discontinuous.

65. The fastening device according to Claim 63 wherein (a) when a test surface congruent in shape to the susceptor surface is placed on the outward side of the adhesive, at least about 35% of the area of adhesive in contact with said test surface can have inscribed within it circles having a diameter of $\frac{1}{2}$ " or less.

66. The fastening device according to Claim 65 wherein at least about 35% of the area of adhesive in contact with said test surface can have inscribed within it circles having a diameter of $\frac{1}{4}$ " or less.

67. The fastening device according to Claim 63 wherein (e) from about 0.05% to about 65% of the total area of the test surface is in contact with the adhesive as measured by the post-bonding test procedure defined herein.

68. The method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 3 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area of the surface to be bonded is in contact with the adhesive after heating.

69. The method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 4 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area to be bonded is in contact with the adhesive after heating.

70. The method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 5 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area to be bonded is in contact with the adhesive after heating.

71. The method of bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 6 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area to be bonded is in contact with the adhesive after heating.

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72. The method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 8 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area to be bonded is in contact with the adhesive after heating.

73. The method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 9 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area to be bonded is in contact with the adhesive after heating.

74. The method according to Claim 70 wherein no more than about 10% of the surface to be bonded is in contact with the adhesive after heating.

75. The method according to Claim 74 wherein the device is heated by induction heating.

76. The method according to Claim 75 wherein the energy for the induction heating is provided by a hand-held device.

77. The method according to Claim 76 wherein the induction heating is provided by electromagnetic energy having a frequency of about 1,000 kHz or less.

78. The method according to Claim 77 wherein the induction heating is provided by electromagnetic energy having a frequency of about 500 kHz or less.

79. The method according to Claim 70 wherein the fastening device is heated by induction heating such that the fastening device is not heated uniformly.

80. The method according to Claim 79 wherein the hottest spots on the fastening device are near the edges of said susceptor.

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81. The method according to Claim 80 wherein the adhesive is concentrated near the edges of the susceptor.

82. The method according to Claim 70 wherein the fastening device has adhesive on two sides of the substrate and is placed between the surfaces to be bonded prior to heating.

83. The method according to Claim 70 wherein the surfaces to be bonded together are selected from wood, plaster, gypsum board, batten, plywood, fabric, wall coverings, vinyl and other polymeric materials, paper, grass, and mixtures thereof.

84. A method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 29 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area of the surface to be bonded is in contact with the adhesive after heating.

85. The method according to Claim 84 wherein no more than about 10% of the surface to be bonded is in contact with the adhesive after heating.

86. The method according to Claim 85 wherein the fastening device is heated by induction heating.

87. The method according to Claim 86 wherein the induction heating is provided by electromagnetic energy having a frequency of about 1,000 kHz or less.

88. The method according to Claim 87 wherein the induction heating is provided by electromagnetic energy having a frequency of about 500 kHz or less.

89. The method according to Claim 87 wherein induction heating of the fastening device is such that the fastening device is not heated uniformly.

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90. The method according to Claim 89 wherein the hottest spots of the fastening device are near the edges of the susceptor.

91. The method according to Claim 90 wherein the adhesive is concentrated near the edges of the susceptor.

92. The method according to Claim 84 wherein the fastening device has adhesive on two sides of the substrate and is placed between the surfaces to be bonded prior to heating.

93. The method according to Claim 84 wherein the surfaces bonded together are selected from wood, plaster, plywood, gypsum board, batten, fabric, wall coverings, vinyl and other polymeric materials, paper, grass, and mixtures thereof.

94. A method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 62 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area of the surface to be bonded is in contact with the adhesive after heating.

95. A method for bonding surfaces together comprising placing the adhesive portion of the fastening device according to Claim 63 against the surface to be bonded and heating the device to activate the adhesive, wherein no more than about 65% of the surface area of the surface to be bonded is in contact with the adhesive after heating.

96. A method for bonding two surfaces wherein a device comprising a susceptor, a heat-activateable adhesive, and the second surface to be bonded, are placed against one of said surfaces and the device is heated to activate the adhesive, wherein when a test surface congruent in shape to the susceptor surface is placed on the outward side of the adhesive, at least about 35% of the pre-bonding area of the outward side of the adhesive in contact with

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said test surface can have inscribed within it circles having a diameter of $\frac{1}{4}$ " or less, and further wherein no more than about 65% of the surface area to be bonded is in contact with the adhesive after heating.

97. The method according to Claim 96 wherein the susceptor has a thickness of no greater than about 2 mils.

98. The method according to Claim 97 wherein a layer of adhesive is placed on each side of the susceptor and the layers are sandwiched between the surfaces to be bonded.

99. The method according to Claim 98 wherein the adhesive is heated by induction heating.

100. The method according to Claim 98 wherein the induction heating is provided by electromagnetic energy having a frequency of about 1,000 kHz or less.

101. The method according to Claim 98 wherein the adhesive and the susceptor are held together by the pressure between the surfaces to be bonded.

102. The method of bonding surfaces together comprising:

- (a) placing an electromagnetically-activateable adhesive article between the surfaces to be bonded so as to form two adhesive-surface interfaces, such that at least one of said adhesive-surface interfaces includes: (1) a pressure-sensitive adhesive, and (2) a non-pressure sensitive adhesive;
- (b) activating said adhesive article, using electromagnetic energy having a frequency between about 1 kHz and about 50 mHz, such that the non-pressure sensitive adhesive forms a bond between the article and the surface.

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103. The method according to Claim 102 wherein the article includes a susceptor selected from metallic foil-based susceptors, non-metallic foil-based susceptors, metallic particle-based susceptors, and mixtures thereof.

104. The method according to Claim 103 wherein the susceptor is a metallic foil-based susceptor.

105. The method according to Claim 104 wherein the susceptor has a thickness of no greater than about 2 mils.

106. The method according to Claim 105 wherein the metallic foil is aluminum or an aluminum alloy.

107. The method of bonding surfaces together comprising:

- (a) placing an electromagnetically-activateable adhesive article between the surfaces to be bonded so as to form two adhesive-surface interfaces, such that at least one of said adhesive-surface interfaces includes a pressure sensitive adhesive;
- (b) activating said adhesive article, using electromagnetic energy having a frequency between 1 kHz and about 50 mHz, such that the pressure sensitive adhesive converts at least partially to a non-pressure sensitive adhesive exhibiting substantially no creep under the usage conditions.

108. The method according to Claim 107 wherein the electromagnetic energy melts said adhesive so as to form a bond with the surface upon cooling.

109. The method according to Claim 107 wherein the article includes a susceptor selected from metallic foil-based susceptors, non-metallic foil-based susceptors, metallic particle-based susceptors, and mixtures thereof.

110. The method according to Claim 109 wherein the susceptor is a metallic foil-based susceptor.

111. The method according to Claim 110 wherein the susceptor has a thickness of no greater than about 2 mils

112. The method according to Claim 111 wherein the metallic foil is aluminum or an aluminum alloy.

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